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TITLE: Automated collaborative filtering in world wide web advertising

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Abstract Text (1):
On the World Wide Web, and other interactive media, it is possible to show different
ads to different people who are simultaneously viewing the same content. This
invention is based on the fact that people who have shown a tendency for similar likes
and dislikes in the past will show a tendency for such similarities in the future.
Those people who strongly display such similarities with respect to a particular
person ("the subject") are referred to as that person's "community." If the members of
a subject's community tend to click on a particular Web ad, then it is likely that the
subject will also tend to click on that ad. This invention combines techniques for:
determining the subject's community, and determining which ads to show based on
characteristics of the subject's community. The information used to determine whether
a given individual should be in the subject's community is gleaned from the
individual's activities in the interactive medium. Means are provided to track a
consumer's activities so all the information he generates can be tied together in the
database, e.g. by means of "cookies;" or by software running on the consumer's
computer, such as an in-line plug-in, a screensaver working in conjunction with the
Web browser, or the Web browser itself. A measure of similarity between individuals is
generated. The individuals with the greatest calculated similarity become the
subject's community; e.g. clusters are formed of groups of very similar consumers. Ads
are presented to the subject based on his community, optionally selected based on
demographics associated with the community.

Brief Summary Text (2):
This invention involves the display of advertising to users of an interactive
communications medium. It is particularly useful with the World Wide Web, which
utilizes a communications protocol on the Internet.

Brief Summary Text (6):
Under the old model for the advertising industry, the subject matter of one "unit of
publication" (a magazine, a newspaper section, a radio show, a TV show) was often the
sole means an advertiser possessed in order to guess the interests of a particular
reader or viewer. If for instance, the magazine was about cars, advertisers knew that
anyone reading it was highly likely to be interested in cars.

Brief Summary Text (7):
However, on the Internet's World Wide Web, multiple units of publication--that is,
multiple Web pages and user actions over time--can be used to determine the interests
of each individual. Moreover, this information can be gathered very inexpensively. To
do this, we take advantage of the fact that a Web user's actions can be tracked over
time. This rich source of information about each person will be used to bring about an
era of far more efficient advertising. The information used includes not only which
sites were visited by the user and for how long, but also which ads the user clicked
on, as well as other information.

Brief Summary Text (8):
Under the old model, as it exists on the Web today, most of this information is
ignored. It is technically possible to acquire it, but it isn't generally being done.

This is due to reasons of momentum of the old model, lack of well-known software and statistical tools for making use of the information, and, not insignificantly, fears of an invasion of privacy (a problem that must be dealt with and that this concept paper will explore below). But this information, when acquired and used, will be extremely useful in trying to make sure that each square inch of the limited Web advertising space on each site is used to effectively reach individual customers.

Brief Summary Text (9):
This ignored information, because of its power to enhance advertising effectiveness, is extremely valuable.

Brief Summary Text (15):
If the members of a particular consumer's community tend to click on a particular Web ad, then there is a certain likelihood that the subject consumer will also tend to click on that ad.

Brief Summary Text (17):
In this invention, the information used to determine whether a given individual should be in the subject's community is gleaned from the activities of the individual in the interactive medium in question. For instance, when the interactive medium is the World Wide Web, the information may involve such facts as the choices of Web sites the individuals have each visited, the frequency of such visits, the nature of the content at those sites, etc. If the sites are online stores, the information may involve the choice of specific items purchased, as well as the prices of those items. As another example, if the site is an entertainment recommendation service based on user-supplied ratings (Firefly at www.ffly.com is an example), the ratings can be used. One more example is the selection of Web ads each individual has chosen to click on. In one embodiment, there is a feature which allows individuals to indicate their disinterest in an ad; this serves as additional input.

Brief Summary Text (21):
In one embodiment clusters are formed of groups of very similar consumers. Then, the subjects community consists of all or some of the other members of his cluster.

Brief Summary Text (23):
In one embodiment of the invention, a new ad is displayed randomly or on a fixed schedule to a certain number of users. During this "training period" for the new ad, a certain percentage of the members of the subject's community will click on it. If this is an unusually high proportion, then there is a relatively high likelihood that the ad will be of relatively high interest to the subject. In one embodiment, statistical techniques are used to determine a probability, associated with a fixed confidence level, with which we can assume a randomly-chosen member of the subject's community will tend to click on the ad; this probability is used as the measure of similarity. Other embodiments involve other analytic techniques.

Detailed Description Text (4):
The centerpiece of this invention is the "Smart Ad Box." A Smart Ad Box is an area on a Web page (usually rectangular) which is used to display Web advertising. Special software algorithms are used to determine which ads are shown to which users; different visitors to a Web page can simultaneously see different ads.

Detailed Description Text (7):
For ease of discussion, this patent will focus exclusively on the use of ACF in Web advertising. However, it must be stressed that ACF can be used in a complementary manner to techniques such as those C.vertline.Net and Novo Media Group are developing. ACF can give us a certain amount of evidence that a particular ad should be shown to a particular user; such information as age, sex, Internet domain, etc. can be considered as well.

Detailed Description Text (10):
When a Smart Ad Box appears on a page, a user viewing that page will see an ad which is targeted to that particular user. Thus, simultaneous viewers of the same page will often be presented with different ads. The ad is visually contained in the Smart Ad Box. The Smart Ad Box may or may not be rectangular in shape; it will often, but not necessarily, exist in a fixed region on the screen.

Detailed Description Text (11):
The Smart Ad Box will present different ads to a user over time. Certainly, simply
showing the same ad over and over again is not maximally effective. The user would
simply become used to it and would therefore come to ignore it. This invention
involves rotating the user through different ads which are of likely to be of interest
to that particular user. The rotation schedule can be chosen for maximal overall
advertising effectiveness. One way to measure effectiveness would be the frequency of
clicks on ads in Smart Ad Boxes--the rotation schedule could be chosen to maximize
this number. It could involve such information as the number of times the user has
seen each ad in the past, and the predicted likelihood that the user will be
interested in the given ad. Another factor that could be considered is resonance with
the Web page showing the ad--perhaps ads that relate in some way to the subject matter
of the page will be more likely to be clicked on.

Detailed Description Text (13):
Moreover, particular implementations of the present invention can optionally include
certain additional features, such as the ability to reject an ad--for instance, with
an option-click of the mouse. A user would do this for an ad that had no interest for
him. The rejected ad would automatically be replaced with another ad targeted to that
user.

Detailed Description Text (22):
For instance, a check box could appear next to each item. If the advertiser clicks a
checkbox for an item which has subordinate items (for instance, the user may have
clicked on the checkbox for a Web site which was listed with its individual pages)
then the checkboxes for the subordinate items could be automatically "checked" or
"filled in" by the software. (Java or JavaScript could be used to do this in
"real-time" instead of requiring the user to submit the form.) But a number of other
mechanisms could be used instead of checkboxes--for instance, the listings could
change color to indicate having been chosen. Checkboxes are probably preferable,
though, since their meaning is so intuitively clear.

Detailed Description Text (24):
5. In the above, whenever a page is listed, it should optionally be possible to click
on the listing to be transported to that page in order to investigate it.

Detailed Description Text (28):
9. The ad listings could, optionally, consist of the ad banners themselves.
Alternatively, they could be "hot-linked" text that the webmaster could click on to be
transported to a page containing the banner (which might additionally have other
information supplied by the advertiser about the ad). There should optionally also be
a way for the webmaster to visit the site that the banner will be linked to; this
could be accomplished simply by hotlinking the banner to the site, just as will be the
case for users. It could also be accomplished other ways, including having a button,
next to the listing for the ad, which is hotlinked to the related site.

Detailed Description Text (45):
To make the process of sending other user's tracking data to Sam more efficient, the
system could optionally be designed so that similar users were grouped into
statistical clusters; all the people in one cluster would be more similar to each
other than to people in any other cluster.

Detailed Description Text (46):
Then, information describing the clusters could be sent to Sam's machine, which could
decide which cluster Sam was in. A variety of different types of information could be
sent to Sam's machine describing each cluster. For instance, the average amount of
time spent on each tracked Web site, where that number is computed from the data
corresponding to all users in the cluster, would be a good candidate. For each
cluster, this number could be sent for every tracked page (or for only a subset of the
tracked pages, which could be chosen, for instance, for their statistical
significance). Then, software running on Sam's machine could determine how closely
each cluster matches Sam's activities; Sam would be considered to be in the cluster he
matches most closely.

Detailed Description Text (47):
Alternatively, instead of sending information about each user or cluster into Sam's
computer, information could be sent about the demographics which apply to each ad.
These demographics could be supplied to the system by the advertiser or ad agency, or
could be determined by a central computer by means of ACF as described elsewhere in
this document.

Detailed Description Text (50):
Optionally, every time Sam clicks on an ad, his demographic information could be sent
to a central database, where it would be used to analyze the overall demographics of
people who click on the ad. However, no identifying information for Sam need be sent
or stored.

Detailed Description Text (60):
Each Web page which contains a Smart Ad Box will contain code, which may be comprised
of HTML, Java, or other languages, which will allow a user to be tracked. (This code
may work in conjunction with other software, such as Netscape-style Inline Plug-Ins.)
In addition, such means for tracking a user can be embedded in pages that do not
themselves display advertising. Pages which have the ability to cause a central
database to be updated with tracking information will be referred to in this document
as "tracking-enabled."

Detailed Description Text (113):
(Note: the Internet screensaver would have commercial value even without its
relationship to the advertising paradigm discussed in this paper, if, for instance,
the user-tracking capabilities were to be omitted. For instance, many Web sites would
benefit from publicizing themselves by means of providing content to the Internet
Screensaver.)

Detailed Description Text (127):
It is an important consequence of this invention that relatively small Web sites
(small in the sense of a relatively small number of daily visitors) will be able to
become participants. Because no human involvement is required on the part of the
company supplying the Smart Ad Box and related services, there is much less of a
barrier to the involvement of these small sites in advertising. Normally, the manpower
associated with making agreements between individual advertisers and ad agencies and
individual Web sites is prohibitive enough that no such agreements are made with small
sites. Thus, this invention will enable many small sites to earn money from displaying
advertising. The largest expense involved in dealing with an individual participating
Web site might be the expensive of writing and mailing a check; of course, Internet
banking may soon lower that cost.

Detailed Description Text (140):
It should also be noted that the techniques described in this section are also useful
for advertising systems that do not involve automated collaborative filtering; as one
example, consider a system that simply uses demographic information supplied by the
individual users in order to decide which ads to display to whom. Such a system could
use the techniques described here to enable Web sites to participate without human
intervention, again leading to the cost savings which would make it very practical to
allow very small Web sites to participate.

Detailed Description Text (141):
It is of significant value to enable these small Web sites to participate, because a
large amount of the time of many who use the Web is spent visiting such small sites.
Making that space available for advertising adds significantly to the potential
revenue stream.

Detailed Description Text (150):
Certain mathematical and statistical techniques can be used to compute a number which
represents the amount of likely similarity of interests in a meaningful way, based on
such profiles. Such techniques are described in the Shardanand thesis, John Hey's U.S.
Pat. Nos. 4,870,579 and 4,996,642 (hereby incorporated by reference). While these
techniques are usually described as being useful for deciding which pairs of people
tend towards the most similar esthetic judgments, the techniques apply equally well to
their basic interests in life, as manifested in, for instance, the types of Web sites

they choose to visit and the types of ads the click on.

Detailed Description Text (155):
Thus, if the advertiser has given information which is stored in the system about what the target audience for an ad is, then the software can check to see which ads are most highly targeted for Joe. However, even if the advertiser hasn't given that information, the software can examine the data to see which demographic groups have showed the most interest in each ad--so the system can supply this information if the advertiser doesn't.

Detailed Description Text (160):
For every ad, we can consider the list of people who are similar to Joe, and compute the ratio of clicks to impressions. For example, if there were a total of 1000 impressions, and 10 people clicked on the ad, the ratio would be 10/1000 or 1/100. (An impression is one showing of an ad to a person.)

Detailed Description Text (169):
Genetic programing could be used to evolve algorithms to transform the similarities to weights. The fitness function would be the algorithm's success in predicting which ads are of interest to Joe. For purposes of the genetic programming process, the fitness function would measure how good a particular algorithm is at "predicting" how interested Joe was in ads that he has already been exposed to, and where we have already counted how many impressions it took him to click on them.

Detailed Description Text (173):
We will again compute the ratio of clicks to impressions. Call it R.

Detailed Description Text (174):
For each ad, there is a probability P that people as similar in taste to Joe as those on the list will click on it in a given exposure.

Detailed Description Text (181):
3. The number of clicks on the ad in question. From a statistical point of view, each click is considered to be a success in the experiment.

Detailed Description Text (191):
In combination with such approaches as are described in this section, cluster analysis can be used.

Detailed Description Text (192):
Instead of comparing Joe to each individual user, we can compare Joe to clusters of similar users. These clusters will be comprised of individuals with similar demographics and/or tracking histories. The degree of similarity between people will be computed as described above; in each cluster, each individual will be more similar to people in his own cluster than to people in other clusters.

Detailed Description Text (193):
Such an approach can be more computationally efficient, since Joe would only need to see which cluster he is associated with, rather than comparing himself to all (or a substantial subset) of the set of individual users.

Detailed Description Text (194):
Most ads will be more of interest to people in some clusters than others; this can be determined by techniques such as those described above, but applying those computations (such as the cumulative binonial distribution) to clusters rather than to individuals.

CLAIMS:

16. The process of claim 15, further comprising the step of grouping the subject into a cluster formed of other subjects with similar communities.

21. The computer program product of claim 17, wherein a plurality of guests with similar communities are grouped into clusters.